CLAIMS:

1. A mass spectrometry system for continuous control of environment by detecting a source of contamination comprising:

system carrying means;

a sampling unit installed in said system carrying means having sample extraction means for extracting samples from said environment, said sampling unit having an output;

an ionization device connected to said output of said sampling unit and supported by said system carrying means, said ionization device forming a beam of ionized particles from said samples, said ionization device having an ionization device input and an ionization device output;

a time-of-flight mass spectrometer, which is supported by said system carrying means and has a mass spectrometer input, mass spectrometer output, and a deflector modulator connected to said ionization device output for alternatingly deflecting said beam of ionized particles with a predetermined angle for dividing said beam of ionized particles into two independent flows guided along two independent trajectories; and

a data acquisition and analysis unit that acquires data from said sampling unit, said ionization device, and said time-of-flight mass spectrometer, said data acquisition and analysis unit having means for analysis of said data and for generating control data that controls and monitors operations of said sampling unit, said ionization device, and said time-of-flight mass spectrometer.

2. The mass spectrometry system of Claim 1, wherein said time-of-flight mass spectrometer comprises:

electrostatic field generation means for generating an electrostatic field for causing said ionized particles in each of said two independent trajectories to fly in a direct path from said mass spectrometer input to a side opposite to said

mass spectrometer input and in a return path from said side opposite to mass spectrometer input towards said mass spectrometer input; and

a charged particle detector means for detecting positions of collisions of said charged particles with said charged particle detector means for determining the time of flight of said charged particles independently for each of said at least two flows, said charged particle detector means being located in the vicinity of said mass spectrometer input.

3. The mass spectrometry system of Claim 2, wherein said electrostatic field generation means comprise:

a plurality of quadrupole electrostatic lenses which are arranged in series and coaxially in said direction of said beams of ionized particles, each of said quadrupole electrostatic lenses comprising a circular body formed by four arch-shaped poles located substantially in a common plane perpendicular to said central longitudinal axis and arranged circumferentially about said central longitudinal axis in the form of a first pair composed of two diametrically opposite and electrically connected poles and a second pair composed of two diametrically opposite and electrically connected poles, in each of said quadrupole electrostatic lenses said poles being angularly shifted with respect to said poles of a quadrupole electrostatic lens subsequent in said direct path by a selected angle in order to provide said angular gradient of the electrostatic field between adjacent quadrupole lenses of said plurality and thus to cause said charged particles to move along said curvilinear trajectories; and

mirror means comprising: an electrostatic mirror located on said opposite side for reflecting said charged particles and for directing said charge particles to said return path.

4. The mass spectrometry system of Claim 3, wherein said deflector modulator comprises: a first electrode plate and a second electrode plate spaced from said

first electrode plate, said first electrode plate being connected to a first power supply that provides deflection of said single flow of charged particles by an angle α towards one of said at least two inlet ports, said second electrode plate being connected to a second power supply via a switching unit that provides deflection of said single flow of charged particles by an angle 2α towards another of said at least two inlet ports; a steering unit for correcting said two independent flows on their way from said ionization device towards said input of said mass spectrometer; and random pulse modulation means connected to said charged-particle deflection means for generating irregular sequence of said charged particles in said at least two flows.

5. The aerosol time-of-flight mass spectrometer system according to Claim 4, wherein said inlet of said mass spectrometer comprises at least a first inlet port and a second inlet port, said steering unit comprising a third electrode plate connected to a source of a permanent potential, a fourth electrode plate connected to a source of a permanent potential, and a fifth grounded electrode located between said third electrode and said fourth electrode, one of said at least two flows of charged particles being directed to said first inlet port via a space between said third plate electrode and said fifth grounded electrode, while another of said at least two flows of charged particles being directed to said second inlet port via a space between said fourth plate electrode and said fifth grounded electrode.

6. The aerosol time-of-flight mass spectrometer system according to Claim 3, wherein said selected angle is equal to 360° divided by the number of quadrupole electrostatic lenses in said plurality.

7. The aerosol time-of-flight mass spectrometer system according to Claim 6, wherein said curvilinear trajectories are helical trajectories.

8. The aerosol time-of-flight mass spectrometer system according to Claim 5, wherein said selected angle is equal to 360° divided by the number of quadrupole electrostatic lenses in said plurality.

9. The aerosol time-of-flight mass spectrometer system according to Claim 8, wherein said curvilinear trajectories are helical trajectories.

10. The aerosol time-of-flight mass spectrometer system according to Claim 4, wherein said means for analysis of said data and for generating control data of said data acquisition and analysis unit comprises a central processing unit, first-level correlators with means for performing a first deconvolution that establishes a non-overlapping trains of data obtained from said charged particle detector means, a second-level correlator with means for performing a second deconvolution and for generating a signal that has an amplitude for determining, by analyzing increase or decrease of said amplitude, whether said aerosol time-of-flight mass spectrometer system approaches or departs from said source of contamination; and a third level correlator for performing a third deconvolution for filtering out a noise from said signal and for identifying species of said particles, said first level correlators, said second-level correlator, and said third-level being connected to said central processing unit; said first-level correlators being connected to said random pulse modulation means.

11. The aerosol time-of-flight mass spectrometer system according to Claim 10, wherein data acquisition and analysis unit further comprises data storage means, said charged particle detector means comprising a first detector for detecting positions of collision of particles in said return path of one of said at least two flows and a second detector for detecting positions of collision of particles in said return path of another one of said at least two flows; said first-level correlators

comprising two correlators of first level of correlation, one of which is connected to said first detector and another one to said second detector; said two correlators of first level of correlation being interconnected through said second-level correlator; and said third-level correlator being connected to said second level correlator and to said data storage means.

12. The aerosol time-of-flight mass spectrometer system according to Claim 9, wherein said means for analysis of said data and for generating control data of said a data acquisition and analysis unit comprises a central processing unit, first-level correlators with means for performing a first deconvolution that establishes a non-overlapping trains of data obtained from said charged particle detector means, a second-correlator with means for performing a second deconvolution and for generating signal that has an amplitude for determining, by analyzing increase or decrease of said amplitude, whether said aerosol time-of-flight mass spectrometer system approaches or departs from said source of contamination; and a third level correlator for performing a third deconvolution for filtering out a noise from said signal and for identifying species of said particles, said first level correlators, said second-level correlator, and said third-level being connected to said central processing unit; said first-level correlators being connected to said random pulse modulation means.

13. The aerosol time-of-flight mass spectrometer system according to Claim 12, wherein data acquisition and analysis unit further comprises data storage means, said charged particle detector means comprising a first detector for detecting positions of collision of particles in said return path of one of said at least two flows and a second detector for detecting positions of collision of particles in said return path of another one of said at least two flows; said first-level correlators comprising two correlators of first level of correlation one of which is connected to said first detector and another one to said second detector; said two correlators

of first level of correlation being interconnected through said second-level correlator; and said third-level correlator being connected to said second level correlator and to said data storage means.

14. The aerosol time-of-flight mass spectrometer system according to Claim 1, wherein said system carrying means comprises a vehicle moveable in said environment.

15. The aerosol time-of-flight mass spectrometer system according to Claim 14, wherein said vehicle is selected from a group consisting of an underwater vehicle, a ground vehicle, and an aircraft.

16. The aerosol time-of-flight mass spectrometer system according to Claim 15, wherein said environment is water, and said vehicle is an underwater vehicle, said underwater vehicle, said system further comprising a remote navigation station and antenna means located outside said water, said antenna being electrically connected to said data acquisition and analysis data and connected to said remotely located navigation system via connection means selected from the group of electrical connection means and wireless connection means, said data storage means being located in a place selected from the group consisting of said underwater vehicle and said remotely located navigation system.

17. The mass spectrometry system of Claim 16, wherein said time-of-flight mass spectrometer comprises:

electrostatic field generation means for generating an electrostatic field for causing said beams of ionized particles in each of said two independent trajectories to fly in a direct path from said mass spectrometer input to a side opposite to a side opposite to said mass spectrometer input and in a return path

from said side opposite to mass spectrometer input towards said mass spectrometer input; and

a charged particle detector means for detecting positions of collisions of said charged particles with said charged particle detector means for determining the time of flight of said charged particles independently for each of said at least two flows, said charged particle detector means being located in the vicinity of said mass spectrometer input.

18. The mass spectrometry system of Claim 17, wherein said electrostatic field generation means comprise:

a plurality of quadrupole electrostatic lenses which are arranged in series and coaxially in said direction of said beams of ionized particles, each of said quadrupole electrostatic lenses comprising a circular body formed by four arch-shaped poles located substantially in a common plane perpendicular to said central longitudinal axis and arranged circumferentially about said central longitudinal axis in the form of a first pair composed of two diametrically opposite and electrically connected poles and a second pair composed of two diametrically opposite and electrically connected poles, in each of said quadrupole electrostatic lenses said poles being angularly shifted with respect to said poles of a quadrupole electrostatic lens subsequent in said direct path by a selected angle in order to provide said angular gradient of the electrostatic field between adjacent quadrupole lenses of said plurality and thus to cause said charged particles to move along said curvilinear trajectories; and

mirror means comprising: an electrostatic mirror located on said opposite side for reflecting said charged particles and for directing said charge particles to said return path.

19. The mass spectrometry system of Claim 18, wherein said deflector modulator comprises: a first electrode plate and a second electrode plate spaced from said

first electrode plate, said first electrode plate being connected to a first power supply that provides deflection of said single flow of charged particles by an angle α towards one of said at least two inlet ports, said second electrode plate being connected to a second power supply via a switching unit that provides deflection of said single flow of charged particles by an angle 2α towards another of said at least two inlet ports; a steering unit for correcting said two independent flows on their way from said ionization device towards said input of said mass spectrometer; and random pulse modulation means connected to said charged-particle deflection means for generating irregular sequence of said charged particles in said at least two flows.

20. The aerosol time-of-flight mass spectrometer system according to Claim 19 wherein said inlet of said mass spectrometer comprises at least a first inlet port and a second inlet port, said steering unit comprising a third electrode plate connected to a source of a permanent potential, a fourth electrode plate connected to a source of a permanent potential, and a fifth grounded electrode located between said third electrode and said fourth electrode, one of said at least two flows of charged particles being directed to said first inlet port via a space between said third plate electrode and said fifth grounded electrode, while another of said at least two flows of charged particles being directed to said second inlet port via a space between said fourth plate electrode and said fifth grounded electrode.

21. The aerosol time-of-flight mass spectrometer system according to Claim 18, wherein said selected angle is equal to 360° divided by the number of quadrupole electrostatic lenses in said plurality.

22. The aerosol time-of-flight mass spectrometer system according to Claim 21, wherein said curvilinear trajectories are helical trajectories.

23. The aerosol time-of-flight mass spectrometer system according to Claim 20, wherein said selected angle is equal to 360° divided by the number of quadrupole electrostatic lenses in said plurality.

24 The aerosol time-of-flight mass spectrometer system according to Claim 23, wherein said curvilinear trajectories are helical trajectories.

25. The aerosol time-of-flight mass spectrometer system according to Claim 197, wherein said means for analysis of said data and for generating control data of said a data acquisition and analysis unit comprises a central processing unit, first-level correlators with means for performing a first deconvolution that establishes a non-overlapping trains of data obtained from said charged particle detector means, a second-correlator with means for performing a second deconvolution and for generating signal that has an amplitude for determining, by analyzing increase or decrease of said amplitude, whether said aerosol time-of-flight mass spectrometer system approaches or departs from said source of contamination; and a third-level correlator for performing a third deconvolution for filtering out a noise from said signal and for identifying species of said particles, said first level correlators, said second-level correlator, and said third-level correlator being connected to said central processing unit, said third level correlator being located in a place selected from the group consisting of said CPU and a place beyond said CPU; said first-level correlators being connected to said random pulse modulation means.

26. The aerosol time-of-flight mass spectrometer system according to Claim 25, wherein data acquisition and analysis unit further comprises data storage means, said charged particle detector means comprising a first detector for detecting positions of collision of particles in said return path of one of said at least two

flows and a second detector for detecting positions of collision of particles in said return path of another one of said at least two flows; said first-level correlators comprising two correlators of first level of correlation one of which is connected to said first detector and another one to said second detector; said two correlators of first level of correlation being interconnected through said second-level correlator; and said third-level correlator being connected to said second level correlator and to said data storage means.

27. The aerosol time-of-flight mass spectrometer system according to Claim 26, wherein said means for analysis of said data and for generating control data of said a data acquisition and analysis unit comprises a central processing unit, first-level correlators with means for performing a first deconvolution that establishes a non-overlapping trains of data obtained from said charged particle detector means, a second-correlator with means for performing a second deconvolution and for generating signal that has an amplitude for determining, by analyzing increase or decrease of said amplitude, whether said aerosol time-of-flight mass spectrometer system approaches or departs from said source of contamination; and a third level correlator for performing a third deconvolution for filtering out a noise from said signal and for identifying species of said particles, said first level correlators, said second-level correlator, and said third-level being connected to said central processing unit; said first-level correlators being connected to said random pulse modulation means.

28. The aerosol time-of-flight mass spectrometer system according to Claim 27, wherein data acquisition and analysis unit further comprises data storage means, said charged particle detector means comprising a first detector for detecting positions of collision of particles in said return path of one of said at least two flows and a second detector for detecting positions of collision of particles in said

return path of another one of said at least two flows; said first-level correlators comprising two correlators of first level of correlation one of which is connected to said first detector and another one to said second detector; said two correlators of first level of correlation being interconnected through said second-level correlator; and said third-level correlator being connected to said second level correlator and to said data storage means.

29. The aerosol time-of-flight mass spectrometer system according to Claim 28, wherein said ionization device further comprising ionization optimization means connected to said central processing unit and to said particle sampling means, and particle acceleration means connected to said central processing unit and to said ionization device.